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METHODS OF TEACHING AGRICULTURE IN SECONDARY SCHOOLS.

INTRODUCTION.

As it is one of the aims of this Monthly to apply methods of teaching agriculture to special topics, it is deemed advisable at this time to set forth in a general way the methods used in agricultural instruction in secondary schools. Inasmuch as agricultural education is yet in the early stages of development we do not aim to give any final word upon this subject. Our work brings us in touch with many secondary schools teaching agriculture. The following suggestions are the results of a study of the methods of others as well as our own experience.

EDUCATIONAL AIMS.

In order to discuss methods of education in an intelligent manner we must first agree upon educational aims. The majority of educators now agree that the general aim of education is social efficiency. The idea set forth by Spencer that education is a preparation for life has been broadened to include life itself. If we can agree that the general purpose of school training is to enable the student to live a happier and more useful life among men, then we can understand the purpose of teaching agriculture in the rural high school. Answers to a recent questionnaire, sent out by this office, reveal the fact that a great majority of the teachers of agriculture in secondary schools consider the vocational aim preminent. Nearly all of those teaching more than one year of agriculture consider the chief aim of the course to be training in practical agriculture. Only those giving short elementary courses consider that they are merely giving information and arousing interest in agriculture. We shall assume that the rural high school aims to train young men and women for efficient country life, and that the particular aim of the course in agriculture is the training of farmers.

It is not to be expected that this work can be accomplished completely in a four-year course, but the high school can give the student a good start in the right direction. The high-school course should stimulate an interest in agriculture and rural life. It should furnish the student a scientific basis on which to build and place him in touch with sources of information. If he is to continue the study of agriculture in college, he should take with him a knowledge of elemental principles and an eagerness to begin training for a more special line of work, with faith in his ability to cope with the problems which will confront him. If he is to practice upon the farm, he should find his training not only a practical aid in securing greater returns

from the soil, but also an inspirational aid in securing more out of farm life. Because of his training he should have a greater appreciation of country life and should look upon farming as a vocation having new dignity.

Methods based on teacher's knowledge of young men and women.—The teacher in the high school should think of himself more as a teacher of young men and women than as a teacher of a particular subject. Although success in teaching depends to a great extent upon native ability, much can be gained in training courses for teachers. In such a course the prospective teacher should become familiar with the psychology of the learning process with special application to the adolescent age. He should learn the fundamentals of the teaching process especially as applied to secondary students. The teaching of agriculture is but a special application of the general principles of secondary education.

Methods based on knowledge of agriculture.—It is evident that no matter how well a man may be trained as a teacher he will not be successful unless he knows well his subject. A knowledge of agriculture implies a very broad training. The teacher of this subject must be trained in both the art and the science of agriculture. He must be able to show his students how as well as to tell them why. In the application of the vocational aim, training in practical farming increases in importance, yet the scientific side of farming should not be neglected. It has been said that it should be the aim of the high school to raise every subject which it touches to the level of a science. The instructor who is to teach the science of agriculture, and develop a scientific attitude in his students, must understand the scientific method and have a broad comprehension of agriculture and the sciences upon which it is based.

ORGANIZATION OF MATERIALS.

Although the outlining of a course of study may be regarded as an administrative problem, it is very closely connected with methods of teaching and involves problems connected with methods. Even if the teacher does not plan the course, he interprets it in its application.

Course based on needs of student.—In planning a course the student must be considered first. Materials as well as methods must be adapted to the needs of the adolescent. The organization of materials and the application of methods of teaching will vary with the age of the student; they will not be the same for first-year students as they will for fourth-year students. The agricultural students may be more mature in one school than in another, hence methods for one school may be unsuited to another.

Course based on needs of community.—The course should be planned to meet agricultural and social needs of the community as well as the needs of the students. The needs of the community are in fact the needs of the student to a great extent. In corn-growing sections corn culture should be given prominence in the course in crop production; and the feeding of corn should be prominent in the course in animal production. It is possible that in such a section more diversification is needed in crop production and a greater variety of animal feeds needed; then emphasis may be given such a crop as alfalfa that may fill that need. In fruit-growing sections emphasis will undoubtedly be placed on horticulture. It is possible that such sections may need to pay more attention to animal husbandry in order to maintain a better balance in their agriculture and to maintain their soil fertility in a better way. It may happen that in some sections where a special crop is grown the students are so proficient in its culture that there is no need to emphasize it. The course should meet the needs of the community as well as its present interests.

Limitations of the school.—Each school presents limiting factors to the application of a course of study and to methods of teaching. Small schools may lack proper equipment and funds for carrying out plans of instruction. In such schools the teacher may have to divide

his time for agriculture with other subjects. Even larger schools may lack equipment in land and other facilities for practical work. Often the very limitations of a school prove advantages to the teacher and students. If an effort is made to make up a lack of time by putting in overtime, and if a lack of equipment is met by improvising apparatus the teacher and students will become all the stronger. Lack of agricultural equipment at the school often results in a wider use of the home farm by the teacher with the result of closer cooperation between home and school. Instruction in vocational agriculture is expensive when compared with most high-school instruction. As a rule the school with the better equipment will give the better course, if other factors are equal.

Influence of preparatory course.—The teacher of secondary agriculture should consider the training his students have had at home and in the elementary school. He should consider especially the work in agriculture and nature study in the grades. Students who have had practical nature study and a good introductory course in agriculture before entering the high school will be prepared to enter the more specialized secondary courses. Where agriculture is not taught in the elementary school it may prove helpful, if not absolutely necessary, to give an elementary course in general agriculture as an introduction to such courses as crop production, animal husbandry, and horticulture as usually taught in secondary schools.

Influence of college demands.—A course in vocational agriculture may not be considered as suitable for college preparation. It may happen that the school is striving to meet college entrance requirements as well as to consider the immediate needs of the students. There may be a question as to why these aims should be incompatible, but it is not our purpose to discuss it at this time. If the teacher is keeping in mind the student who is going to college as well as the student who is going onto the farm it may affect the course in agriculture he is teaching.

CORRELATIONS WITH OTHER SUBJECTS.

Correlation with natural science.—Botany, zoology, chemistry, physics, and physiography are commonly taught in the high school. If these sciences are to merit a place in the secondary curriculum they should be interpreted in terms of the pupil's daily experiences and interests and applied to their lives. In a rural community the teaching of agriculture affords an excellent means of applying a great many of the principles of these sciences. General agriculture can not be taught as a science without involving all of the sciences named, hence it becomes very necessary to correlate the teaching of agriculture with the teaching of science. If these correlations are made in a consistent, logical way, all branches will be mutually benefited. In the small schools where the teacher of agriculture must teach some other subjects there is an advantage in having him teach the natural sciences, especially the biology. In schools where the subjects are taught by different teachers, the principal should see that there are consistent and harmonious correlations. Agricultural applications should be made in the teaching of science wherever possible, and in the teaching of agriculture the scientific principles involved should be brought out in a definite way. In planning the course these correlations should be kept in mind. Work with soils should be given at the same time as the course in physiography or following that course. In the course in physiography, or surface geology, emphasis should be placed upon the making of soils and in the course which deals with soils this phase of the subject may be reviewed and applied. A course in botany may precede the courses in farm crops and horticulture, or it may be given at the same time. If it is made practical, emphasis will be placed upon how plants grow, with abundance of application to economic plants. The classes which consider the plant side of agriculture will have continual need for this knowledge. In like manner, the course in zoology may be correlated with the work in animal husbandry and with the control of pests. Many principles of physics and chemistry will be brought out

in the study of agriculture before the students study these subjects as special courses. When these courses are taken up the agricultural students will be well prepared for them and will be able to apply their principles to agricultural science and practice. The need for a foundation knowledge of science is making an elementary course in general science popular with schools teaching agriculture. This course is usually given the first year. In some schools it is so intimately correlated with the introductory course in agriculture that the two courses become one.

Correlation with the humanistic branches and mathematics.—There are few subjects taught in the rural high school which can not be correlated with agriculture to the betterment of all subjects.

The classes in English may utilize agricultural topics as themes. The teacher of agriculture should insist on the best English of which the student is capable in his written and oral reports. In some cases agricultural papers are used by the teacher of English in connection with studies of composition. Drawing is another means of expression which should be emphasized in agriculture and correlated with that subject when taught separately.

There is need for more practical mathematics in the high school and application of the subject to farming in rural districts. In agricultural classes there is constant need for mathematics. In giving problems to the student the teacher of agriculture should consider the mathematics the students are taking and have had, and the teacher of mathematics should consider the agriculture the students are studying, so that the correlation will be reciprocal.

The development of the student into a well-trained, patriotic citizen who is contented to spend his life aiding in rural development will depend much upon the correlation of agriculture with the social sciences—history, civics, economics, and sociology. In the teaching of these subjects emphasis should be placed upon the part agriculture has had in the developing of the race and the Nation, upon the importance of agriculture as an industry, and the important place of farmers in our national life. In the teaching of agriculture it should not be forgotten that the training of men comes ahead of the training of farmers. It is possible in the teaching of this subject to develop the highest ideals of community service and to establish the highest standards of citizenship.

Correlation with mechanic arts.—In some rural high schools mechanic arts is essentially a part of the course in agriculture, being given as farm mechanics or as a phase of rural engineering. Where given separately there should be close cooperation of departments and the closest correlation of subjects. Exercises in mechanic arts should have a definite relation to the farm and the farm home. In all branches of agriculture practicums involving mechanical skill will have value. Students in horticulture may make hotbeds; students in animal husbandry may make hog cots or poultry houses; and students in agronomy may lay draintile. Such exercises should be given in cooperation with the department of mechanic arts where such a department exists separately from the agricultural department.

USE OF THE TEXTBOOK.

Most secondary-school subjects have been taught by the so-called textbook method. As a natural result of this, when agriculture was introduced into the high school it was with the use of a textbook. Agriculture has been taught in many schools by teachers who have lacked training in the subject. These teachers have been so dependent upon the textbook that they have found it very difficult to get away from it. As suggested before, agriculture should be adapted to the needs of the students and the community. A textbook must cover a region more or less extensive. It may offer suggestions to the teacher as to organization of materials and methods of presentation and to the student, subject matter; but it should not be followed slavishly if the best results are to be obtained. In all texts there will be some topics of little

importance in the community or for which there will not be time. There is so much material outside of the book that may be made to fit the needs of the class that the teacher can not afford to spend time on all subjects just because they are in the textbook. The order of sequence must often be changed to meet class needs. The number of books intended for use in secondary schools is increasing and their quality improving. They should be welcomed by teachers as aids to the courses given but should not determine altogether what will be taught or the method that will be used.

THE LECTURE METHOD.

In the case of subjects for which there has been no suitable textbook many teachers have followed the lecture method. The fact that this method is used so extensively in college accounts to a great extent for its use in secondary schools. It happens too often that the secondary teacher gives to his students the same material he received in college in much the same manner that it was given to him. Talking before the class may be good for the teacher, but it is not good for the students. The more the students put into a recitation the more they will get out of it. It will be necessary for the teacher to supplement reports of the students and to take part in the discussions, but he should take care that he does not use too much of the time. The lecture method has little place in the secondary school.

REPORTS BY STUDENTS.

It is much better for the students to do the talking under the direction of the teacher. In carrying out this idea some teachers supplement recitations from textbooks and other general class assignments by having students report upon special topics. Perhaps a bulletin of general interest to the class is assigned to a student who has a special interest in the subject. After a thorough study a report involving the essential points of the publication is made before the class. A subject may be assigned which involves a study of a number of references, or the report may cover a special project or problem worked out at home or in the laboratory or a visit of agricultural interest. A tendency to let the most able students report most frequently should be guarded against. This method should be used to develop weak students; while it serves well for that purpose, it should not be used at too great a sacrifice of the interests of the class as a whole.

ROUND-TABLE DISCUSSIONS.

The more general the participation of the students in a class recitation the better it will be for the class. In some schools the class recitation is but an informal discussion of assigned readings, practicums, field trips, and home projects. This method is followed chiefly where the course is centered around practical agriculture. It is most successful with small classes of fairly matured students. It is not easy to break away abruptly from methods used in the elementary school. Often it is necessary to use more formal methods with first-year students, especially when the classes are large. It may be necessary in these classes to draw out a discussion with questions at first and gradually develop the topic method. The teacher must decide if informal discussions will be best for his students and how soon they are ready for it. Methods used in teaching other subjects and the general rules of discipline in the school have an influence upon methods which may be used in teaching agriculture.

USE OF ILLUSTRATIVE MATERIALS.¹

Principles involved.—As a rule students enrolled for a study of agriculture in rural high schools are familiar with farming materials and lacking in a knowledge of agricultural principles. It is a fundamental rule of pedagogy that the student should proceed from the more familiar

¹This subject is treated in greater detail in the October issue of this Monthly.

to the less known and from the concrete to the abstract; hence the need of utilizing the familiar concrete materials of the farm in approaching the abstract principles of agricultural science. It should be borne in mind that all students learn largely through what they see and that some students are especially dependent upon their eyes for obtaining impressions. Intelligent visualization of the lesson is essential in arousing and maintaining interest.

Illustrative material in the classroom.—If the teacher has proper appreciation of the value of visual instruction, abundant use will be made of the blackboard in placing before students outlines of lessons, important points to be remembered, facts involving figures or data which may be expressed in a graphic way. Illustrations drawn on the blackboard and those from books and farm papers will find a place in most lessons. Charts and maps may be used to advantage in many agricultural lessons. Wherever possible the school should own a good stereopticon and sets of agricultural slides. The teacher should use a camera in securing original material for classroom use.

In considering a great many agricultural topics it is not necessary to depend alone upon printed illustrations or blackboard drawings. Much agricultural material may be brought into the classroom. Material such as plants, insects, and seeds may be mounted and used in the wintertime when it is no longer available for outdoor study.¹ A museum of such material should become a part of the equipment of every high school teaching agriculture.

Field trips.—Many phases of agriculture are studied most profitably out of doors. For example, in a study of crops, methods of culture as well as the crop itself may be studied in a visit to a field where the crop is growing. In the study of animal husbandry, field trips for observation of methods as well as practice in judging are almost an essential to success. Institutions and factories concerned with agriculture and its products may be visited with profit. These trips must be planned and supervised with a definite aim in view if they are to have educational value.

THE LABORATORY METHOD.

Agriculture has followed closely the teaching of other sciences in the high school, hence it has utilized the laboratory method more or less from the beginning. Not having any other guides to follow it has used in many cases much the same materials and apparatus as those used in other sciences, or has followed somewhat closely the exercises used in the agricultural colleges. As a result, much of the laboratory work in agriculture lacks definite aim and application, having therefore but little educational value. For convenience in discussing laboratory exercises they will be classified as follows: (1) Experiments, (2) verifications, (3) demonstrations, and (4) practicums.

Experiments.—Those exercises which aim to discover truth new to the student are classed as experiments. Agriculture as a science is dependent upon men of research, who through their investigations are discovering new knowledge, much of which may be applied to the art of farming. Much of this knowledge is now available in books and bulletins, so that students do not need to seek it from primary sources. While it is not the function of the high school to discover new truths nor even to train scientists, secondary agricultural students should become familiar with methods of research, especially the methods used in the agricultural experiment stations, which have such an important relation to the teaching of agriculture in this country.

Exercises may be planned to impress upon the student the following essentials of an experiment: (1) A clear comprehension of the object of an experiment, (2) an open-minded attitude

¹ For directions concerning the collection and mounting of this material see Collection and Preservation of Plant Material for Use in the Study of Agriculture, U. S. Dept. Agr., Farmers' Bulletin 586 (1914), and Collection and Preservation of Insects and Other Material for Use in the Study of Agriculture, U. S. Dept. Agr., Farmers' Bulletin 606 (1914).

as to probable results, (3) control of all factors except the one tested, and (4) accuracy and a knowledge of probable causes of errors. Experiments may be performed in the laboratory or upon the farm. For example, a student may test the effect of different mulching material on the conservation of moisture with pots or cans of soils in the laboratory. The scales may be used and quantitative results secured. If it is desired to learn the effects of different mulches on the growing crop, the experiment may be performed with a crop on the school or home farm. In either case the student has no definite knowledge of what the result will be. It is not to be expected that experiments will form a large part of the laboratory work. Those given as exercises should come after skill has been developed through verifications as suggested below.

Verifications.—In this class are included those exercises which aim to verify or confirm facts or principles known to the student. Most of the so-called experiments outlined for secondary students really come under this class of exercises. Such exercises are valuable in satisfying the student that statements of facts and principles or laws are true; in making more vivid impressions; and in developing skill in research methods. A student may read in a bulletin or text that sodium nitrate has a certain effect on plants under certain conditions. In testing out the effect in the laboratory or in the field he not only becomes assured of its truth, but he also has the fact impressed in a manner never to be forgotten. If the exercise has been planned and supervised as it should have been, he will have acquired some skill and developed some interest in and appreciation of the work of investigators. The high school should afford an opportunity for young men to find themselves. The laboratory exercises should be conducted in such a manner that those who have a natural leaning toward research may have their interest stimulated rather than checked.

Demonstrations.—These include those exercises in which the teacher or some member of the class uses materials and apparatus in teaching the class principles already known to the demonstrator. In case an exercise is too difficult for the students or equipment is not available for each student it may be conducted by the teacher, or some one who has had special preparation, for the benefit of the class. In this there is an application of the inductive method of teaching. Abstract laws and principles are approached through manipulation of materials familiar to the student. Each step should be clearly understood by the student so that when the demonstration is completed proper conclusions may be drawn. These exercises have the same effect and value as verifications except that the student does not get the practice and the interest associated with doing the thing himself. There is often economy of time as well as materials in a demonstration, as everything should be in readiness before the exercise begins.

Demonstrations may be made for the purpose of showing students how a practicum is to be carried out. The teacher may prune or spray a tree or judge farm animals before the class in order that they may have a better idea of how they are to do the work. Another type of demonstration will be considered under home projects.

Practicums.—Those exercises in which the chief aim is the acquiring of skill and in which the knowledge of the student is applied are termed practicums. In applying the vocational aim in agricultural education practice becomes of the utmost importance. The student can not become successful as a farmer unless he becomes skillful in applying the knowledge he has gained. In the teaching of agriculture it is often assumed that the student is capable of more farm practice than he really knows. In order to be satisfied that the student knows the art as well as the science in connection with the different branches of agriculture covered by the course, certain requirements may be made which involve skill in practice. If these requirements are not met by previous training of the student or by school practicums the work should be done at home. For example, every student should know how to plow and to harness and handle a two, three, or four horse team according to the practice of the community. He should

be able to handle the other implements and machines common in the agriculture of his section. Where commercial fertilizers are needed, he should be capable of mixing them according to the needs of his father's farm. Special attention should be given practice in connection with the chief crops of the section. In corn growing sections for instance, emphasis should be placed on skill in such practices as selection and testing of seed, husking, and stringing of ears. Students of animal husbandry and dairying should develop skill in judging animals as an aid to selection. They should know how to mix rations suitable to the requirements of economic production; to milk a cow in a skillful, sanitary way; to run a separator and clean it properly; and to teach a calf to drink. If poultry husbandry is emphasized the student may be required to run an incubator and brooder or at least to set a hen in a proper manner and to test eggs skillfully. In horticulture, students should become proficient in such practice as simple budding and grafting, making of cuttings, planting of trees, pruning, mixing and application of spray mixtures, and the packing of fruits and vegetables.

Whoever is to direct the practicums must be skillful and thorough in every detail. If the teacher does not feel competent to direct work in a line of agriculture important in the community he should use the services of an expert wherever possible. He should realize that the formation of right habits is very important with the adolescent who is getting a start toward a vocation. He should also realize that the students are prone to imitate and should appreciate the force of example. Under the direction of such a teacher this work becomes more than an application of knowledge and a drill toward skill; it becomes a medium through which the student may express the best that is in him.

The nature of the work at the school will depend much upon the equipment. With very simple and inexpensive apparatus, such exercises as the testing of milk, testing of farm seeds, scoring and judging of farm products, and simple methods of plant propagation may be conducted. For more extensive work with plants, a school garden with a greenhouse is essential. Hotbeds and cold frames may supplement the greenhouse, or may even be used in substitution for it. For practice in the handling and care of milk, and in the making of butter and cheese, a dairy is essential. For good practice in farm mechanics a well-equipped shop is needed, although much is done toward teaching students to use tools and to make farm appliances at schools having little equipment. One school which was visited recently had made arrangements with a neighboring farmer to use his shop; at another school a near-by creamery was used for dairy practice. The use of some land under control of the school is considered by many an essential to the teaching of practical agriculture. The use of a school farm in connection with agricultural teaching involves too many factors to be considered fully at this time. The school land should be used to give the students practice in farm operations. This phase of instruction is more important where students are not living on home farms while attending school. The farm work should have a definite relation to the class instruction and should be under the most careful supervision.

In the teaching of agriculture there is a growing tendency to make the farm the laboratory of the school. Where the school does not own a farm abundant use is made of the farms surrounding the school, as well as the home farms of the students. In connection with instruction in animal husbandry, visits are made to neighboring farms for practice in stock judging and in connection with control of pests and disease. In connection with the study of horticulture arrangements are made with owners of orchards near by for practice in pruning, spraying, picking, and packing. Classes in rural engineering visit neighboring farms for study and practice in connection with farm buildings, farm machinery, and the irrigation or drainage of farm lands.

The laboratory and field work should be a definite part of each course and definite time provided for it. The proportion of the time devoted to this work will depend upon the course

to some extent. Such courses as dairying and farm mechanics may be mostly practical work while other courses may be taught mostly in the classroom. As a rule, when a subject is given five days a week two of these are devoted to laboratory and field work, the periods for such work being double the length of the class recitation. It is preferable to have the practical work come at the end of the day, as some exercises may run overtime. If the students do not have to attend a class after the practical work, they will not have to change clothes again or worry about personal appearances. All exercises should be planned ahead so that materials and equipment may be provided and in working order, and all necessary arrangements made for work in the field. Students should be notified of the nature of the work to be done, so they may dress suitably for the work they are to do. Most of the practice at school will be given as class practicums, i. e., the students do the work as a class. The home work will be largely individual. It may be a problem as to how to secure the best results with required home work. At some schools special credit is given for home practicums and home projects. The contest idea may be used to advantage with students of high-school age. A day may be set apart for agricultural exhibits and contests covering such work as judging farm animals and farm products, rope work, fruit packing, stringing of corn ears, etc. Many of the home practicums will become features of the home projects where the project plan is in operation.

HOME PROJECTS IN SCHOOL WORK.

Definition.—The following definition of a home project is suggested: The term “home project” when applied to instruction in elementary and secondary agriculture includes each of the following requisites: (1) There must be a plan for work at home covering a season or a more or less extended period of time; (2) it must be a part of the instruction in agriculture of the school; (3) there must be a problem more or less new to the pupil; (4) the parents and pupil should agree with the teacher upon the plan; (5) some competent person must supervise the home work; (6) detailed records of time, method, cost, and income must be honestly kept; and (7) a written report based on the record must be submitted to the teacher.

Essentials of a successful home project.—A distinction should be made between home projects and the comparatively simple exercises discussed under laboratory methods. These exercises for the most part are utilized to illustrate and apply some principle, or for the purpose of increasing skill in some farm operation. A project to be worthy of the name should involve skill in many operations, the application of a number of principles and problems of general management. To accomplish this it should cover a branch of farming that will extend over a comparatively long period of time. As it is to be a part of the instruction in agriculture it should have a definite relation to the course of study. Growing an acre of corn would mean the application of many principles of agriculture and would involve skill in general farm operations as well as those connected especially with corn culture, hence it would be a suitable project for a student in general agriculture or agronomy. Caring for an orchard or a garden would be a suitable project for a student in a class in horticulture because it would involve many of the principles and practices of that phase of farming. Students in animal husbandry may select as projects the care of a flock of poultry, or of one or more pigs in which the general principles of animal production will be applied. If the project is to have the highest educational value it must involve new problems. A student may grow an acre of corn year after year and continue to learn something new, but if the work of the first year has been directed properly it will have far greater educational value than that of the succeeding years. After growing corn one year the student may better take up some other crop, or better still an entirely different phase of farming.

The home project when properly administered is an excellent means of bringing the home and school together in their educational problems. The teacher should know the home conditions surrounding the student and should not attempt to plan a project without first getting the consent of the parents. Not only should their consent be obtained, but every attempt should be made to secure their hearty cooperation. A written agreement may be found essential in securing this cooperation. As far as possible the student should be given entire responsibility regarding the work and should have a financial interest in its outcome.

Supervision is necessary in order that those in charge may be sure the work is carried out as outlined. It is even more essential that some one take an active interest in aiding with problems which may arise, and in giving encouragement. It will be most satisfactory as a rule to have the teacher, who conducts the class work, supervise the projects. As the summer season is the most important time for most projects, this plan will necessitate the employment of the teacher of agriculture throughout the year.

The keeping of accurate records and accounts will involve some special instruction in farm accounts. The records kept will form the basis of a written report to the teacher.

Classification of projects.—A class in agriculture may undertake to build a henhouse or barn upon the school grounds or to prune or spray a neighboring orchard; such work may be called a class project or a group project. The projects we are discussing are individual home projects. It is obvious that a home project is performed at home. The projects may be grouped according to their chief aim as follows: (1) Production projects, those projects in which the chief aim is to produce an agricultural product at a profit; (2) demonstration projects, those projects in which the chief aim is to demonstrate materials and methods in agricultural practice; (3) improvement projects, those projects in which the chief aim is to make improvement with hope of little immediate returns; and (4) management projects, those projects in which the chief aim is to apply efficiently the general principles of farm management.

Project study outlines.—Teachers should have their students use outlines as guides in their study and work. It may be a good plan to have the students make their own outlines. These guides may be arranged with one of the following purposes in mind: (1) As a guide to a study of the subject, (2) as a practical plan for carrying out the project, (3) as a combination of both study guide and working plan. Some outlines which have been used successfully have the topics expressed in question form, with reference to books and bulletins in which the information may be secured.

USE OF REFERENCE MATERIAL.

Form and amount of such material.—The books intended for farmers and for students of agriculture are not only increasing very rapidly in number but are also improving greatly in quality as well. Although most of the publications are not intended primarily for secondary schools, there are few of them that can not be used by such schools for reference purposes. This fact is also true with regard to a great number of experiment station bulletins. The impetus recently given agricultural extension has increased the number of nontechnical, expository bulletins and circulars which may be used to supplement the school texts. In addition to the publications of this department, the State colleges and the experiment stations, various boards of agriculture, and many commercial institutions publish material which may be used by secondary schools. All of this material may be obtained at slight cost; in fact, much of it is free. The leading agricultural journals should be available for use of the students as well as papers of local importance.

Efficiency in use.—The teacher of agriculture should keep in touch with the sources of these publications and should aim to arouse interest in his students in collecting such material as may have value in connection with their study and practice. Students may be required to obtain

such available bulletins as have a direct bearing upon their courses and projects. Lists of bulletins needed with instructions for obtaining them should be furnished early, so that no time will be lost in waiting for publications.

For most reference reading students must depend upon the school library. With so much material available there is little excuse for a high school being without some kind of an agricultural library. Much of the best reference material is in the free publications, but in such a form that it is often overlooked. The teacher should use a card-index system, so that students may readily find the available information on any topic which may be assigned. Bulletins should be in suitable boxes arranged according to the card-index system in use. Covers may be provided for bulletins which are used extensively. If files are not kept of the farm papers, clippings may be made of such articles as have a bearing upon the subjects studied. These clippings may be placed in large envelopes or letter files and indexed under title of subject with the bulletins. If the students are made acquainted with sources of information and established in efficient habits in the use of that information, much will be accomplished in their training.

NOTES AND REPORTS.

One habit which means much in efficiency in the use of information is the taking of notes and the keeping of written records. To establish this habit, students should be required to take notes in the classroom when others are reporting, to keep accurate records of all important actions, observations, results, and conclusions in laboratory, field, and project work, and to report upon reference reading. Forms used for records and reports will vary with the school and the nature of the work. The loose-leaf laboratory manual in which directions for the exercises are followed by space for the student's report is popular. Information secured in the school may be available for ready use in subsequent years if the students are encouraged to make notes on cards and file them according to subject with a card index in much the same way they file information clipped from papers.

Students need training and practice in expressing themselves in writing, so that written reports and essays should be called for frequently and criticized carefully. Written reviews will aid the teacher not only in checking up on the work of the student, but also upon his own work as a teacher. It will be found that some students are able to express themselves better on the written page than orally. Both written and oral reports, then, are needed to do justice to all students and to give them the training needed.

THE USE OF FARMERS' BULLETINS IN TEACHING FARM MECHANICS IN SECONDARY SCHOOLS.

INTRODUCTION.

Agricultural engineering, embracing farm mechanics, is a comparatively new subject of instruction in secondary schools. So much that is of a practical value may be embraced in such a course that it is becoming very popular in schools having a vocational aim in the teaching of agriculture. Farm mechanics is not a subject to be studied from books; it involves a great deal of practice in actually doing the thing, hence it appeals to the motor-minded youth. There has been a need for suitable directions for carrying out the practicums to be included in such a course. Recently this department issued Farmers' Bulletin 638, Laboratory Exercises in Farm Mechanics for Agricultural High Schools, to meet this need. The following suggestions are given regarding the use of other recent Farmers' Bulletins in supplementing Bulletin 638.

POULTRY-HOUSE CONSTRUCTION (FARMERS' BULLETIN 574).

Building a poultry house may be made a part of the course in poultry husbandry, a part of the course in farm mechanics, or a cooperative project between the two classes. Where poultry husbandry and farm mechanics are taught as separate courses the latter plan is the best. Houses may be built as a class project upon the school grounds or upon neighboring farms, or they may be built by individual students in connection with a home project in poultry husbandry. At a school in New York visited recently the students had made a comparatively large poultry house and two colony houses on the school farm as class projects. These houses served well for demonstration purposes. There were 10 students conducting poultry projects at home; each of these students had either built a new house or had remodeled an old one to conform to modern ideas of construction. In addition to the houses built by the students, 8 new houses and 12 colony houses were built by patrons in the district as a result of the stimulation given by the school. Complete directions are given in the bulletin for building some excellent houses.

A SIMPLE TRAP NEST FOR POULTRY (FARMERS' BULLETIN 682).

Some schools may not enter into either poultry husbandry or farm mechanics so extensively as to desire to build a poultry house, yet they desire to make their work practical as far as they go. Such schools will find the construction of trap nests both practical and far-reaching in its results. The aim in building a trap nest at the school should be not only to give the students practice in the use of tools and to teach them to make a useful device, but also to stimulate an interest in the building and use of trap nests in the community. If the school can succeed in awakening an interest in this work it should result in an increased egg production in the district.

The teacher should have no difficulty in having the students make a three-compartment nest according to directions given in the bulletin. The work may be done by the class at school or by individual students at home.

A PLAN FOR A SMALL DAIRY HOUSE (FARMERS' BULLETIN 689).

Dairying is another branch of agriculture which if taught thoroughly will involve a great deal of practice. Special instruction in dairy husbandry can not well be given without provision for practice in such work as separating, making of butter and cheese, and the testing of milk and its products. This work requires a room equipped especially for the handling of milk. The most satisfactory plan for many schools which have not had their buildings constructed with such work in mind is to build a small dairy house, such as is planned in this bulletin. The students will then gain instruction in handling milk under such conditions as may be secured at home. The dairy building at the school should serve as a demonstration of a house much needed in most rural communities.

This house may be built by students in dairying and farm mechanics, under the direction of the teacher, according to plans given in the bulletin. In sections where natural ice is obtainable it may be desirable to plan for the storage of ice in connection with the dairy. Plans for ice houses will be found in Farmers' Bulletin 623, Ice Houses and the Use of Ice on the Dairy Farm.

OTHER BULLETINS ON FARM ENGINEERING AVAILABLE.

There are a great number of department publications on agricultural engineering available for teachers. These bulletins, in addition to farm buildings, cover such subjects as farm mechanics, road improvement, drainage, and irrigation. A list of the bulletins prepared for the use of teachers may be obtained from this office.

